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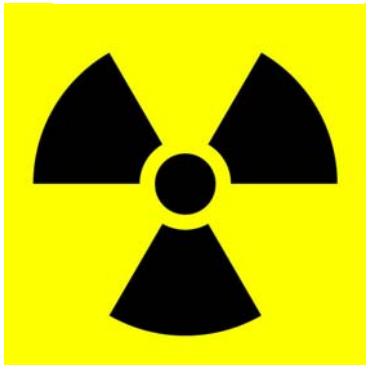
Radiology

Radiation Caution Signs (6/09)

Question: Our clinic is installing new intraoral x-ray tubeheads in all of our dental operatories. Do we need radiation cautionary signs in all of these rooms? Are there specific wording and color requirements for the signs?

Radiation Symbol



Answer: With the deployment of digital dental radiography in all Air Force clinics, many facilities are decentralizing radiology by installing intraoral tubeheads in dental operatories. Before these recent installations, many clinics used a central radiology room for the majority of their x-ray exposures. Often the central radiology room is lead-lined and has a specific lead-lined barrier or booth that the x-ray technician stands behind while exposing radiographs. Usually, the technician closes the door while exposing radiographs and at a minimum, a sign such as, "*Please knock before entering, X-ray Room*", is posted on the door or near the entrance to the room. Some clinics may even have the official standard radiation symbol posted to caution staff and patients. Another sign that has commonly been posted in dental waiting rooms and/or centralized radiology rooms is a sign requesting women to notify the dental staff if they may be pregnant.

Specific definitions and policies governing the posting of cautionary signs in regard to radiation are published in Nuclear Regulatory Commission Regulations, Title 10 Code of Federal Regulations (10 CFR) Part 20: *Standards of protection against radiation*, and are also specifically addressed by the Air Force in AFI 48-148 *Ionizing Radiation Protection*. The following definition of **"Radiation Area"** is found in 10 CFR 20.1003:

> "***Radiation area*** means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates."

The actual signage posting requirement is outlined in10 CFR 20.1902:

> ***"Posting of radiation areas***. The licensee shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA."

It is very unlikely that enough exposures could be taken to ever reach the dose equivalent levels in one hour in any dental radiology treatment room. Thus, our dental operatories and central radiology rooms do not meet the criteria to be defined as a "**Radiation Area**". For this reason, posting radiation caution signs within dental facilities, especially with the official radiation hazard symbol, is not required. Most medical x-ray facilities and rooms are also exempt from this policy.

The following describes several scenarios and recommendations for caution signs.

Central Radiology Area
If exposures are made by a dental technician occupying the same room as the patient (e.g., central radiology), with a closed door or in a room where the technician can not control entrance by other staff

members or patients into the room during an x-ray exposure, it is prudent to post a, "*Please knock before entering, X-ray Room*" sign or equivalent at the entrance to the room. A sign bearing the official radiation symbol is not required.

Dental Operatories with X-Ray Units
As long as standard radiation surveys have been conducted to verify the safe use of the x-ray tube head within the dental operatory, cautionary signs are not required at the entrance to the operatory. In this instance, the dental technician/dentist leaves the room before the exposure and can monitor patient/staff traffic in the area during the x-ray exposure.

Using a Handheld X-Ray Unit
When using a handheld x-ray unit like the NOMAD™ or NOMAD Pro™ in a dental operatory, the dental team member (dentist or technician) not using the unit can be posted at the door to ensure that there are no unintended entrances to the room during the x-ray exposure.

Radiation Cautionary Signs and Pregnancy
AFI 48-148 (*Ionizing Radiation Protection)*, Section 4.5 addresses "*X-ray Examination of Women*" with sections 4.5.1 and 4.5.3. applying to dental x-ray examinations. Section 4.5.1 clearly states that all female patients shall be asked if they are pregnant before any radiology procedure. This should be standard procedure for our dental providers since they review the medical history with each patient before any examination or treatment. Dental radiology technicians in a central radiology room should always ask female patients if they are pregnant before taking dental x-rays. Section 4.5.3. specifically excludes dental waiting or examination rooms from the requirement to post signs reminding the patient to notify the staff if they may be pregnant.

These guidelines do not preclude Air Force dental clinics from posting cautionary radiation signs which exceed the recommendations stated above. Additionally, it is not recommended that clinics remove signs which have already been posted or have been based on local policy decisions.

From AFI 48-148 (*Ionizing Radiation Protection)*:
• 4.5.1. Before any diagnostic radiology or nuclear medicine procedure, the patient shall be asked if they are pregnant.

• 4.5.3. Radiographic and nuclear medicine waiting and/or examination rooms, ***other than those used exclusively for dentistry***, shall be posted with appropriate signs alerting patients that if they may be pregnant to notify the physician or technician before the examination.

References:

- Air Force Instruction 48-148, Ionizing Radiation Protection (2001 edition). Available at www.e-publishing.af.mil/. Accessed June 2009.

- Nuclear Regulatory Commission Regulations, Title 10 Code of Federal Regulations (10 CFR) Part 20: Standards of protection against radiation (2007 edition). Available at www.nrc.gov/reading-rm/doc-collections/cfr/. Accessed June 2009.

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Detecting Safelight Problems in the Darkroom (5/07)

Question: How often should we test for light leaks in the darkroom? Can you review the recommended testing procedures for detecting light leaks or problems with the safelight?

Answer: Routinely checking darkrooms for light leaks and safelight operation are important aspects of a dental radiography quality assurance program. Light leaks, inappropriate safelight filters, or stray light from other sources in the darkroom may result in fogging of film and subsequent loss in detail and contrast. According to the National Council on Radiation Protection and Measurements (NCRP)

When to Evaluate Darkroom Integrity
- Upon initial installation
- Monthly
- After a change in the safelight filter or lamp

Report No. 145: "Each darkroom and daylight loader shall be evaluated for integrity at initial installation, and then monthly and following change of room lighting or darkroom safelight lamp or filter."

Follow this simple method to evaluate your darkroom for light leaks and safelight performance:
- With the safelight on in the darkroom, place a coin on an unwrapped film for a period of time that is equivalent to the time required for a typical darkroom procedure.
- Process the film.
- Detecting an image of the coin on the film indicates a problem with either the safelight or light leaks in the darkroom.
- Repeating the above procedure with the safelight off will determine which was the source of the problem.

References
- American Dental Association Council on Scientific Affairs The use of dental radiographs update and recommendations. J Am Dent Assoc 2006;137:1304–1312.
- National Council on Radiation Protection and Measurements. Radiation protection in dentistry. Bethesda, Md. 2003;35–37.

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Exposure Times for the NOMAD™ Portable X-Ray System (1/07)

Question: Our clinic just started using the new portable NOMAD x-ray unit. The exposure times published in the accompanying manual seem incorrect. Our images seem to be underexposed (i.e., light). Do you have any information regarding more accurate exposure settings for the NOMAD?

Answer: The Dental Evaluation and Consultation Service (DECS) has evaluated the NOMAD™ x-ray unit (ARIBEX, Inc.) and one of the clinical evaluators stated that most of the published recommended exposure times in the manual needed to be increased. The original manual had one set of recommended exposure settings for digital sensors and three sets of recommended settings for different film speeds. DECS consulted ARIBEX about their original recommended exposure times and received an immediate response. They agreed that the exposure times published in their original manual may be too short for many digital sensors. The original chart was developed with 70kV prototype units. The NOMAD was eventually marketed at 60kV and the times were empirically adjusted for the lower energy level x-rays. Another comprehensive study at 60kV was not accomplished before market entry resulting in the inaccuracies in the chart. Inherent variability also arises because there is a significant difference between the sensitivity of the different brands of digital sensors. There can also be some variation in radiation intensity from each NOMAD x-ray unit, although ARIBEX states this variation should never be more than +/- 10%. Subsequently, in an effort to better characterize the NOMAD with digital sensors, ARIBEX enlisted the help of the University of Texas at San Antonio to create more accurate guidelines. These results are summarized into a new and more complete Technique Factor Chart which will be incorporated into their Users' Manual.

Suggested exposure settings range from 07 when using Schick sensors with children, to 70 when using Kodak Ultraspeed (D-speed) film on a large adult. A general rule of thumb/starting point is to use a setting of 20 for digital sensors and 50 for film. These settings should work for all sensors, except Schick which seem to be more sensitive than the other sensors. Please note that the researchers used a Rinn positioning system with the rod cut to a shorter length to clear the backscatter shield. If you use a positioning system and do not cut off the rod then the NOMAD will be positioned further from the patient's face and the times will need to be increased. Variation in times from one facility to another may vary depending on the technique used.

Phosphor plate (PSP) systems present another problem. The image intensity is a function of the readout speed on the scanner. Some facilities deliberately go to a fast readout speed so that they don't have to wait as long for the images. The University of Texas put their scanner at the "optimum" readout speed and in their opinion, it was necessary to use a setting of 20 on the NOMAD to get the best images.

ARIBEX states that from their initial experience with customers, better images with the PSP systems may be obtained by increasing the setting to about 40. They believe that this is because of the readout speed differences.

In most situations the new Technique Factor Chart should provide an improved estimate of settings that will provide acceptable images; however, each facility will need to adjust times as necessary to determine the best exposure settings for each image medium used (e.g., traditional film, direct digital sensor, phosphor plate). Suggested exposure levels can initially be verified for each medium using a step wedge device.

Reference
Clark Turner, Ph.D., ARIBEX, Inc, Orem, Utah, personal communication, November 2006.

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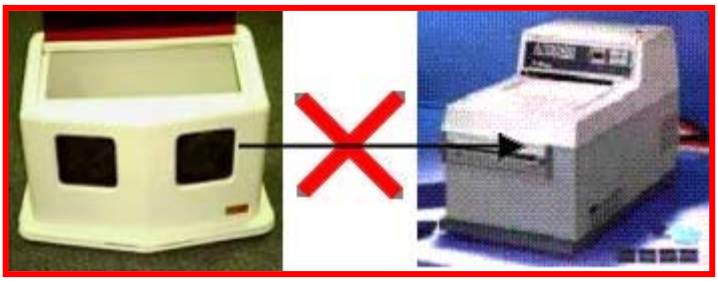
Reprocessing Quick-fixed Radiographs (12/05)

Question: Can a quick-fixed film be reprocessed in an automatic x-ray processor?

Answer: When a quick-fixed film is reprocessed in an automatic processor the fixer on the film may contaminate the developer in the automatic processor and affect image quality of subsequently processed films.



Quick-fixing is indicated when an image is needed quickly (e.g., endodontic diagnostic films) and when the film does not need to be archived. According to most manufacturers of rapid-processing chemicals, a quick-fixed image may not be stable over time, so if the film is to be archived it may need to be refixed in a non-quick-fixing solution.

When reprocessing a quick-fixed film in a manual film processor, the film can be placed directly into the fixer. Automatic film processors are more problematic in that the processor cover would need to be removed in order to access the fixer directly. An option would be to maintain a separate container of fixing solution in the darkroom, solely for this purpose.

The bottom line, however, is that quick-fixed films should not be routinely placed into an automatic film processor since they may contaminate the automatic processor developing solution.

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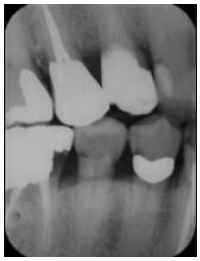
New ADA Guidelines on Dental Radiographs (3/05)

Question: Have there been any changes in recommendations by the American Dental Association in the selection of patients for dental radiographic examination?



Answer: The American Dental Association, working with the federal Food and Drug Administration and dental specialty groups, has updated the FDA's 1987 Guidelines on Dental Radiographs. The guidelines are intended to serve as a resource for the practitioner and are not intended to be a standard of care, requirements, or regulations. The new guidelines were accepted by the FDA in November 2004 and can be found on the ADA website at www.ada.org/prof/resources/topics/radiography.asp

The guidelines incorporate the following updates:

- An additional clinical category entitled "Other Circumstances," which describes the use of radiographs in assessing patients implants, monitoring remineralization of enamel, and evaluating restorative and endodontic needs and other pathology.

- Specific monitoring of edentulous patients.
- Expanded use of panoramic examination, recognizing that the panoramic technology has improved over the last 15 years.
- Clarification that "bitewings" refers to either or both horizontal and vertical bitewings.
- An updated bibliography that can be a valuable reference for the practitioner.

The guidelines are not substitutes for a clinical examination. Radiographs should be taken only when there is an expectation by the dentist that the diagnostic yield will affect patient care.

Further guidance for prescribing radiographs in Air Force dental clinics can be found in the Air Force Medical Service Dental Clinical Practice Guidelines. Dentists in Air Force clinics must complete a clinical examination or record review before requesting radiographs.

References:
- American Dental Association. The Selection of Patients For Dental Radiographic Examinations. www.ada.org/prof/resources/topics/radiography.asp Accessed January 2005.
- Air Force Medical Service Dental Clinical Practical Guidelines.
- AFI47-101, Section 4.4.1, May 2000.

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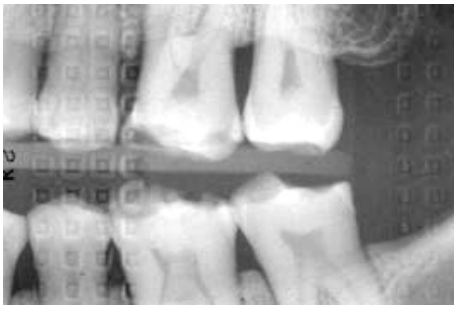
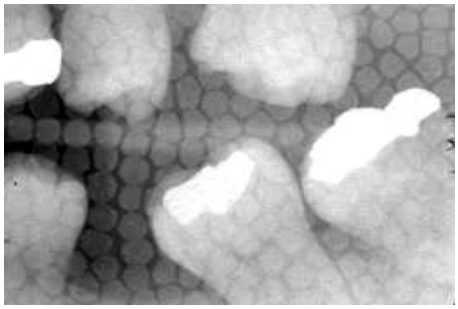
Patterns from Backward Film Placement (12/04)

Question: What pattern will be seen when an x-ray film has been exposed to radiation when the film was placed in the mouth backwards?

Answer: Kodak intraoral x-ray film is marked with an indicator dot to help indicate the tube side of the film and to help distinguish the patient's right or left sides. In addition, the film packet contains a sheet of lead foil which prevents unnecessary radiation from passing through into the patient and reduces scatter radiation. The sheet of foil is marked with a special pattern. Kodak D speed film (ultraspeed) uses a "tire tract" pattern and F speed film (Insight) uses a "ping-pong" pattern. When the film is exposed on the wrong side, the pattern is visible on the radiograph. Due to the attenuation of the foil, the radiograph also appears light in density. Exposure variability would affect how well the pattern shows up on the developed film. Clinicians should view dental x-rays on a view box with magnification and not just hold the film up to overhead lighting (hallway diagnosis). Do not just focus on the teeth but view the whole film to avoid missing important information.



"Tire Tract" Pattern



"Ping Pong" Pattern

References
- Kodak Dental Radiography Series, Successful Intraoral Radiography, Eastman Kodak Co. 2002 www.kodak.com.
- USAF Oral & Maxillofacial Radiology Consultant, personal communication.

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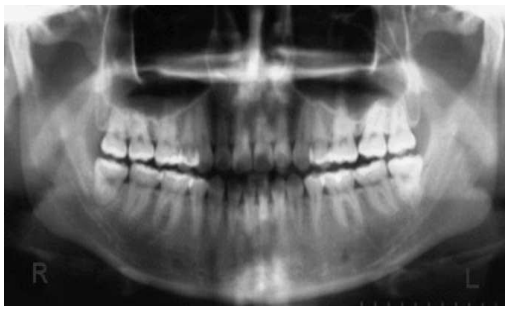
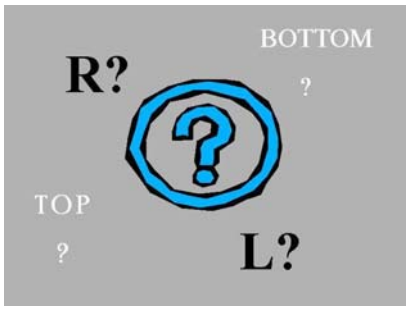
Backward Cassette Placement with Panoramic X-Ray Machines (12/04)

Question: Is it true that some panoramic x-ray machines allow the cassette to be placed in backwards, resulting in a reversed image?





Answer: Yes. This is a concern that must be addressed. All panoramic units should be checked for the potential to load a cassette backwards. DIS is aware of two units with this potential and there may be others.

It was brought to the Dental Investigation Service's attention that the Orthopantomograph 100 panoramic cassette can be inserted backwards, resulting in a reversed image. Even though the reversed radiographic image bears telltale signs (reversed "left" and "right" marker and an image of the springs), there is potential for the error not being discovered. The Air Force Medical Logistics Office posted a medical alert and DIS published recommendations to minimize the risk of incorrect cassette-insertion.

Recently, the manufacturer of the Orthopantomograph 100, Instrumentarium-Imaging, developed a modification for its OP 100, OC 100, and Ortho ID panoramic units. Installation of these modified cassette-holders will ensure proper insertion of the cassette.

As another example, a standard cassette can be inserted backwards into the Planmeca PM 2002CC Proline. However, Planmeca has an optional cassette with a protruding "autoprint" feature that prevents reversed cassette-insertion. Even if the autoprint feature will not be utilized, purchase of this cassette should prevent incorrect insertion.

An alternative solution for cassettes which may be inserted backwards is to tape lead foil in the shape of an "**X**" on the back of the cassette that will serve as an indication on the processed film that the cassette was improperly loaded. In all cases, personnel should be adequately trained.

With so many panoramic machines on the market, every facility should evaluate their panoramic machine for the possibility of improper cassette-insertion. If the possibility exists, corrective action must be taken. For further assistance contact the Dental Investigation Service.

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Instrumentarium Imaging Announces Panoramic Radiography Modifications

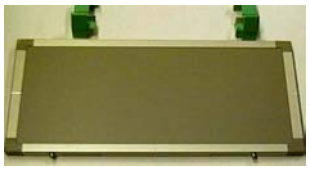
Instrumentarium Imaging has introduced a modification for the OP100, OC100 and OrthoID radiographic units. The design change will allow film cassette insertion into units only in the correct orientation and this change is intended to prevent inadvertent backward placement of the cassette into the unit that will result in a reverse-image film. The revision involves the addition of asymmetric pins to the top of the 15 x 30 cm film cassette and custom cassette holder guides that necessitates insertion in only one orientation.

New Cassette Design with Pins

Insertion of New Cassette into Modified Tunnel

Existing units can be upgraded with the purchase of kit that contains both the new tunnel end guides and cassettes.

Upgrade Kit



Upgrade Kit Type	Kit code
Cassette with Kodak Lanex Medium screens with quides	60761
Cassette with Kodak Lanex Regular screens with quides	60762
Cassette with Kodak Ektavision screens with quides	60763
Cassette without screens with quides	60764

Existing cassettes can be used but will require shipment to the manufacturer for the proper placement of guide pins. To date, the manufacturer has not provided government prices or the time involved for factory upgrade. For pricing and further information please contact Instrumentarium Imaging (800) 558-6120, (414) 747-1030, (414) 481-8665 FAX or info@usa.instrumentarium.com

For a copy of the manufacturer's technical bulletin please click here.

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